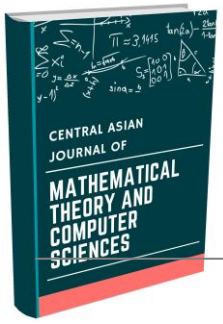

CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES

https://cajmtcs.centralasianstudies.org

Volume: 04 Issue: 12 | Dec 2023 ISSN: 2660-5309

A REVIEW OF THE PATIENT HEALTH STATUS MONITORING SYSTEM BASED ON THE INTERNET OF THINGS (IOT)

Dr. Mohand Lokman Al-dabagh, Farah Ali Tahseen Al-najjar

Computer Technical Engineering College, northern Technical University, Mosul, Iraq

Abstract

The improvement in sensing technologies makes a huge development in different platforms, internet of things (Iot) is one of the best tools and techniques have used to develop the behavioral and physical monitoring systems, The enormous increase in the number of older persons living alone has led to development of systems to track their state of physical health. The study's objective is to find out how IoT applications are used in the medical industry, and its part in improving the quality of healthcare services health care settings. The study uses a descriptive research methodology and analyzes the literature that has been written in this area. The latest results discuss how IoT is being used in medical centers, which will evaluate the level of care given to the patient. However, by using IoT applications for remote diagnostics, it will lower the number of periodic patient checks at the hospital. Additionally, a health institution application will help provide accurate data for the diseases that patients had, Additionally, a health institution application will help provide accurate data for the diseases that patients had. this study talks about the use of healthcare monitoring system (HCMS), using the Internet of things (Iot) with provide a general overview about it.

ARTICLEINFO

Article history:
Received 3 Oct 2023
Revised form 20 Nov 2023
Accepted 6 Dec 2023

Keywords: *ECG; IoT; e-health; HCMS.*

---

1. INTRODUCTION

Internet of Things (IoT), a new generation of computer technology, enables the handling and transfer the data, software, and sensors via the internet. Internet of Things (IoT) is an interesting technology that allows for the control and management of intelligent objects that are linked to the Internet via an address[1].The leading causes of sudden deaths are thought to be heart issues. Blood pressure, body temperature, and heart rate are all highly important human body characteristics. As a result, engineers have created a variety of medical equipment to examine and diagnose a wide range of diseases. Using IoT applications he has loaded

on his smartphone for processing and monitoring the patients, the doctor is able to monitor the patient remotely due to the e-healthcare system. Without being taken to a hospital, the monitoring procedure can be completed out anywhere and at any time.

some many wireless devices, including Zigbee ,Wi-Fi,6LoWPAN and Bluetooth, have recently made it simple, easy and affordable to link various devices to the Internet. The idea of "e-health" is an unique strategy for implementing an healthcare monitoring (HCMS) system that uses electronic methods and techniques through the Internet, and it is discussed within the structure guide of the healthcare monitoring system (HCMS). Terminal users, smart sensing equipment, and servers are the three components that make HCMS and e-health systems[2].

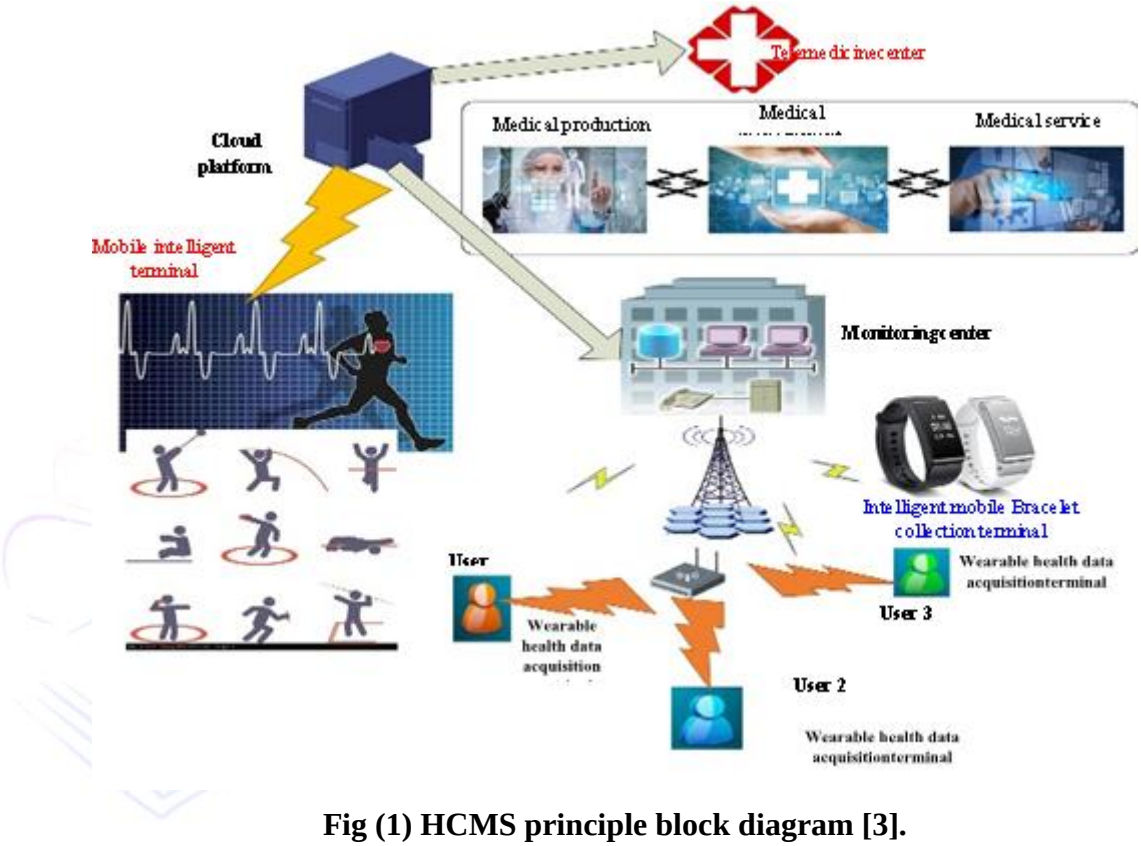

Fig (1) HCMS principle block diagram [3].

The system schematic diagram displayed in Fig(1) system primarily made up of a cloud platform, a mobile intelligent terminal, and a health data gathering terminal. It gathers data on the physical health status of the human body using sensors, preprocesses it, and also transmits the information to a mobile intelligent station over a Bluetooth or wireless network. To store and analyze data on the cloud platform, the mobile intelligent terminal transmits physiological parameters using the Wi-Fi network, in order to perform out remote and real-time monitoring of many bodily physiological indications, and carry out operations such as data transmission, data detection, data trend presentation , historical data storage, intelligent danger warning, and others.

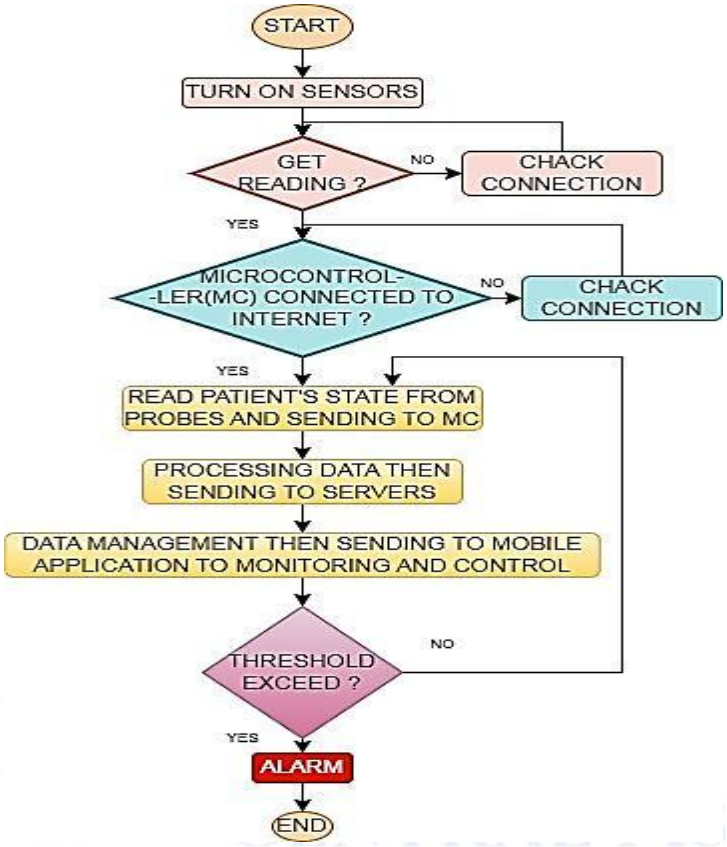

Fig (2) Flow chart showing the opportunities provided by (IoT) HCMS

In order to protect and manage the health of the people, modern technology such as computers and mobile phones are being used, is referred to as Iot applications in HCMS. An IoT application for HCMS, also known as an e-health system or mobile HCMS, uses a set of health services. Fig(2) displays a flow diagram to demonstrate the opportunities provided by IoT in HCMS.

In order to choose communication technology for internet of things devices, Transmission rates and Communication Standards should be chosen for Data Transfer Applications. The physical infrastructure of the IoT-based HCMS is provided by a variety of networking standards.

Table(1) lists a few of them, divided into two categories, short range (one that includes equipment that works with near-field communication, Bluetooth, Z-Wave, and ZigBee systems, as well as passive and active (RFID) systems), and the long distance communication protocol (such as Sigfox, LoRa, and NB-IoT). The maximum coverage range for short range communication technologies is 100 meters, whereas the maximum coverage range for long range communication technologies is tens of kilometers Technologies for long distance communication need little energy and can reach a wide region. [4].

Table(1) : The permitted and prohibited frequency bands.[5]

Type	Frequency bands	Transmission distance	Data rate	Type of network
License spectrum				
802.11p	5.9 GHz	<1 km		WLAN
802.11af	54–790 MHz	1 km	26.7–568.9 mbit/s	
SigFox	868 or 902 MHz	Rural: 30–50 km	100 bps (UL), 600 bps (DL)	LPWA

LoRaWAN 3GPP NB-IoT (cellular)Telensa	Various, sub-GHz 450 MHz–3.5 GHz 60 MHz, 200 MHz, 433 MHz,	< 20 km < 35 km 1 km (Urban)	0.3–37.5 kbps 250 kbps 62.5 bps (UL), 500 bps (DL)	
Ingenu/OnRamp 3GPPLTE-MTC (Cat-M1)EC-GPRS WiMAX	2.4 GHz 1.4 MHz GSM licensed bands 2–11 GHz, 10–66 GHz	15 < 5 km < 5 km Up to 50–80 km	78 kbps (UL), 19.5 kbps (DL) 200 kbps 240 kbps 70 Mbps	WWLAN
Unlicensed spectrum				
WirelessHART	2.4 GHz	< 228 m	250 kbps	WFAN
WiMAX	2–11 GHz, 10–66 GHz	Up to 50–80 km	70 Mbps	WWAN
NFC	13.56 MHz	< 20 cm	424 kbit/s	P2P

2. RELATED WORKS

In earlier research, the internet of things was used to track people's health, where various techniques and technologies are utilized. Table(2) lists comparable research on health monitoring systems. These studies can serve as a guide for creating this health monitoring system because they each have advantages and apply different technologies.

Table (2): RELATED WORKS

Ref	Display	Software	Sensor	Placement	Technology	Parameter(s)
[6]	Smart phone	Blynk Application	AD8232 ECG sensor	Knee, Wrist, Chest, Finger	Arduino Uno	ECG
[7]	Computer	Website	MAX30100, IR Thermometer, Wrist BP module	Wrist	ZigBeeGPRS	Blood Pressure, Heartbeat, Temperature
[8]	smartphone	Processing application	Bioprotech ECG T7016	Knee, Wrist, Chest, Finger	Arduino Uno	
[9]	Android Computer	Java Website	Accelerometer, ECG, gyroscope	Wrist	WSN Cloud	Heartbeat, Oxy
[10]	Smart Phone Backend Server		MAX30100	Finger	Cloud Service	Oxy, Heartbeat
[11]	computer	MGUI	MAX30100	Finger	MCU Operation	Heartbeat, Oxy
[12]	Smart phone	Serial plotter	AD8232 ECG sensor	Finger	Arduino Uno	ECG

[13]	Smart Phone computer	WebsiteJava	ECG Sensor PPG Sensor Accelerometer Gyroscope	Knee, Wrist, Chest, Finger	ZigBee	Heartbeat, Knee Movement, Oxy, Temperature
[14]	computer, Smart Phone	JavaWeb Server	ECG Sensor	Wrist	Cloud-Assisted	Heartbeat
[15]	Computer, Android	Java	Echocardiograph (ECG)	Wrist	Cloud Processing WSN	Heartbeat, Oxy
[16]	IP address	Web Page	Heartbeat pulse, blood pressure and heart sound sensors kits	Knee, Wrist, Chest, Finger	Raspberry Pi	ECG
[17]	Web page IP	SMS Acknowledgment	Heart Beats sensor	Finger	Raspberry Pi	ECG
[18]	Smart Phone computer	IMEC Monitoring System	ECG Sensor	Ankle, Wrist, Chest	Wireless	Heartbeat, Motion Sensor,Respiratory
[19]	computer	One SystemGUI	Phototransistor,Infrared, ADXL Accelerometer, LM35	Wrist Finger	XBee	Heartbeat, Temperature
[20]	Smart phone or pc	Reporting emergency case as an email	The pulse oximeter, blood oxygen saturation, ECG, glucose sensors connected to a gateway router	Finger	6LoWPAN	ECG

3. CONCLUSION

Many healthcare organizations are working to improve patient health satisfaction and service quality. One of the best things that can be done to enhance the quality of health services offered by this institution is to use Iot. Applications of the Internet of Things (IoT) will benefit the successful health institution in a number of ways, including raising the standard of services by improving diagnosis and analysis. Relying on IoT applications for remote diagnostics can help hospitals save time and money by lowering the number of patient reviews. Researchers will have access to data structured and usable

References

1. O. K. T. Al Sultan and A. R. Suleiman, “Simulation of IoT Web-based Standard Smart Building Using Packet Tracer,” *Proc. 7th Int. Eng. Conf. “Research Innov. Amid Glob. Pandemic”, IEC 2021*, pp. 48–

53, 2021, doi: 10.1109/IEC52205.2021.9476125.

2. Y. J. Fan, Y. H. Yin, L. Da Xu, Y. Zeng, and F. Wu, "IoT-based smart rehabilitation system," *IEEE Trans. Ind. Informatics*, vol. 10, no. 2, pp. 1568–1577, 2014, doi: 10.1109/TII.2014.2302583.
3. N. Xiao, W. Yu, and X. Han, "Wearable heart rate monitoring intelligent sports bracelet based on Internet of things," *Meas. J. Int. Meas. Confed.*, vol. 164, 2020, doi: 10.1016/j.measurement.2020.108102.
4. R. I. S. M., K. DAEHAN, K. MD. HUMAUN, H. MAHMUD, and K. KYUNG-SUP, "The Internet of Things for Health Care: A Comprehensive Survey," *IEEE Access*, vol. 3, pp. 678–708, 2015.
5. K. T. Kadhim, A. M. Alsahlany, S. M. Wadi, and H. T. Kadhum, "An Overview of Patient's Health Status Monitoring System Based on Internet of Things (IoT)," *Wirel. Pers. Commun.*, vol. 114, no. 3, pp. 2235–2262, 2020, doi: 10.1007/s11277-020-07474-0.
6. D. Hasan and A. Ismaeel, "Designing ECG Monitoring Healthcare System Based on Internet of Things Blynk Application," *J. Appl. Sci. Technol. Trends*, vol. 1, no. 3, pp. 106–111, 2020, doi: 10.38094/jastt1336.
7. M. H. Riaz, U. Rashid, M. Ali, and L. Li, "Internet of things based wireless patient body area monitoring network," *Proc. - 2017 IEEE Int. Conf. Internet Things, IEEE Green Comput. Commun. IEEE Cyber, Phys. Soc. Comput. IEEE Smart Data, iThings-GreenCom-CPSCom-SmartData 2017*, vol. 2018-Janua, pp. 970–973, 2018, doi: 10.1109/iThings-GreenCom-CPSCom-SmartData.2017.180.
8. "Design and Implementation of Low-Cost ECG Monitoring System for the Patient Using Smartphone."
9. "Wireless Body Area Network s dan Pengaruhnya dalam Perkembangan Teknologi m-Health."
10. S. Rajkumar, M. Srikanth, and N. Ramasubramanian, "Health monitoring system using Raspberry PI," *2017 Int. Conf. Big Data, IoT Data Sci. BID 2017*, vol. 2018-Janua, pp. 116–119, 2018, doi: 10.1109/BID.2017.8336583.
11. E. Jovanov, V. R. Nallathimmareddygari, and J. E. Pryor, "SmartStuff: A case study of a smart water bottle," *Proc. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. EMBS*, vol. 2016-Octob, pp. 6307–6310, 2016, doi: 10.1109/EMBC.2016.7592170.
12. P. Kalaivani, T. Thamaraiselvi, P. Sindhuja, and G. Vegha, "Real Time ECG and Saline Level Monitoring System Using Arduino UNO Processor," *Asian J. Appl. Sci. Technol.*, vol. 1, no. 2, pp. 160–164, 2017, [Online]. Available: www.ajast.net.
13. E. M. G. Rodrigues, R. Godina, C. M. P. Cabrita, and J. P. S. Catalão, "Experimental low cost reflective type oximeter for wearable health systems," *Biomed. Signal Process. Control*, vol. 31, pp. 419–433, 2017, doi: 10.1016/j.bspc.2016.09.013.
14. S. Patel, H. Park, P. Bonato, L. Chan, and M. Rodgers, "A review of wearable sensors and systems with application in rehabilitation," *J. Neuroeng. Rehabil.*, vol. 9, no. 1, 2012, doi: 10.1186/1743-0003-9-21.
15. M. Hassanalieragh *et al.*, "Health Monitoring and Management Using Internet-of-Things (IoT) Sensing with Cloud-Based Processing: Opportunities and Challenges," *Proc. - 2015 IEEE Int. Conf. Serv. Comput. SCC 2015*, pp. 285–292, 2015, doi: 10.1109/SCC.2015.47.
16. A. Kubal, "Design of E-Health Monitoring of Patient using Internet of Things," *Int. J. Latest Technol. Eng.*, vol. VI, no. Viii, pp. 140–144, 2017, [Online]. Available: www.ijltemas.in.
17. S. Lavanya, G. Lavanya, and J. Divyabharathi, "Remote prescription and I-Home healthcare based on IoT," *IEEE Int. Conf. Innov. Green Energy Healthc. Technol. - 2017, IGEHT 2017*, 2017, doi: 10.1109/IGEHT.2017.8094069.
18. S. Majumder, T. Mondal, and M. J. Deen, "Wearable sensors for remote health monitoring," *Sensors*

(Switzerland), vol. 17, no. 1, 2017, doi: 10.3390/s17010130.

19. K. Malhi, S. C. Mukhopadhyay, J. Schnepper, M. Haefke, and H. Ewald, "A zigbee-based wearable physiological parameters monitoring system," *IEEE Sens. J.*, vol. 12, no. 3, pp. 423–430, 2012, doi: 10.1109/JSEN.2010.2091719.
20. Z. U. Abideen and M. A. Shah, "An IoT based robust healthcare model for continuous health monitoring," *ICAC 2017 - 2017 23rd IEEE Int. Conf. Autom. Comput. Addressing Glob. Challenges through Autom. Comput.*, 2017, doi: 10.23919/IConAC.2017.8082012.